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(54) ELASTOMER PROCESSING APPARATUS  
 WITH DISPLAY

(71) We, THE B. F. GOODRICH COMPANY, a Corporation organised and existing under the laws of the State of New York, United States of America, of 277 Park Avenue, New York, State of New York 10017, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to monitoring the operation of an elastomer processor, and providing a readout of the values of various operating parameters at certain intervals in an operating cycle.

In the preparation of uncured elastomer for use in manufacturing tyres, hose belts and other articles of reinforced or unreinforced elastomer, the elastomer has various substances incorporated therein during a mixing process to provide desired properties. The mixing requires that the elastomer be mechanically worked, as in a Banbury mixer or other mixing apparatus, with additional ingredients added at various intervals during the mixing cycle. Difficulties have been encountered in obtaining uniform characteristics of such mixtures from batch to batch. This has resulted from uncertainties in how long a batch should be worked and at what points in a mixing cycle should the various ingredients be added.

One criterion used in determining when to add ingredients or how long to work the compound is the temperature of the compound being worked. This is somewhat inexact due, in large measure, to the difficulty of accurately measuring the temperature of the compound as it is being worked. Another criterion employed as to when additional ingredients are to be added has been based on the length of time working has taken place. This, however, has not proved satisfactory since various elastomers respond differently to working and small differences in timing may be significant. Moreover, depending upon the combination of the ingredients added to an elastomer, the length of time of working that should be required before the addition of another ingredient may vary. Another criterion employed in determining when to add ingredients to an elastomer during the working operation has been based on determining the amount of energy consumed by the working apparatus and then adding ingredients in dependence upon the amount of energy consumed.

It has been found desirable to provide a readout of the aforementioned criteria or parameters (work performed, temperature, and time) during the working operations from batch to batch. Means are preferably provided to make a permanent record of the readouts so as to provide a detailed mixing history. Such information will provide ready identification of improperly mixed batches. Moreover, mixing rates for black oil, or other ingredients can be determined from such a mixing history. Also, if the mixing history includes information as to both elapsed time and the amount of energy consumed during a mixing operation, then information is available to determine the cost of a particular mixing specification compared to another mixing specification for a particular compound. Also, such a mixing history would permit identification so as to quantify the "first batch effect", which may be defined as the time necessary to reach thermal stability.

The invention provides elastomer processing apparatus comprising means for mechanically processing the elastomer, electrically energized drive means for driving said processing means such that electrical energy is expended as work performed on said elastomer, means for sensing the amount of work performed as a function of the expended electrical energy as